2 Sheets--Sheet 1.

J. HOUPT.

Compound Condensing Apparatus for Marine Steam-Engines.

No. 168,901. Patented Oct. 19, 1875.

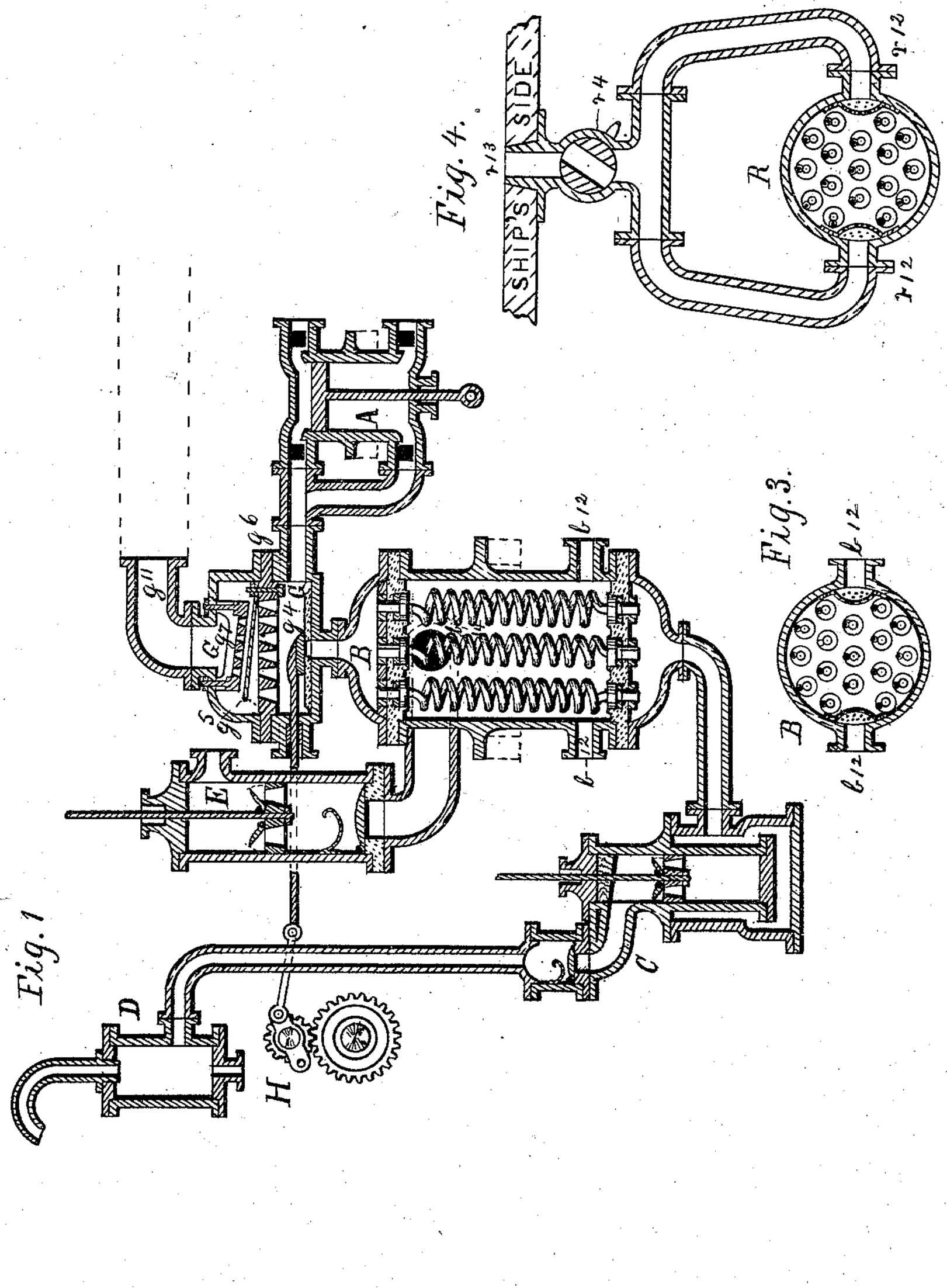

Fig. 4.

Fig. 3.

Fig. 1

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Inventor:
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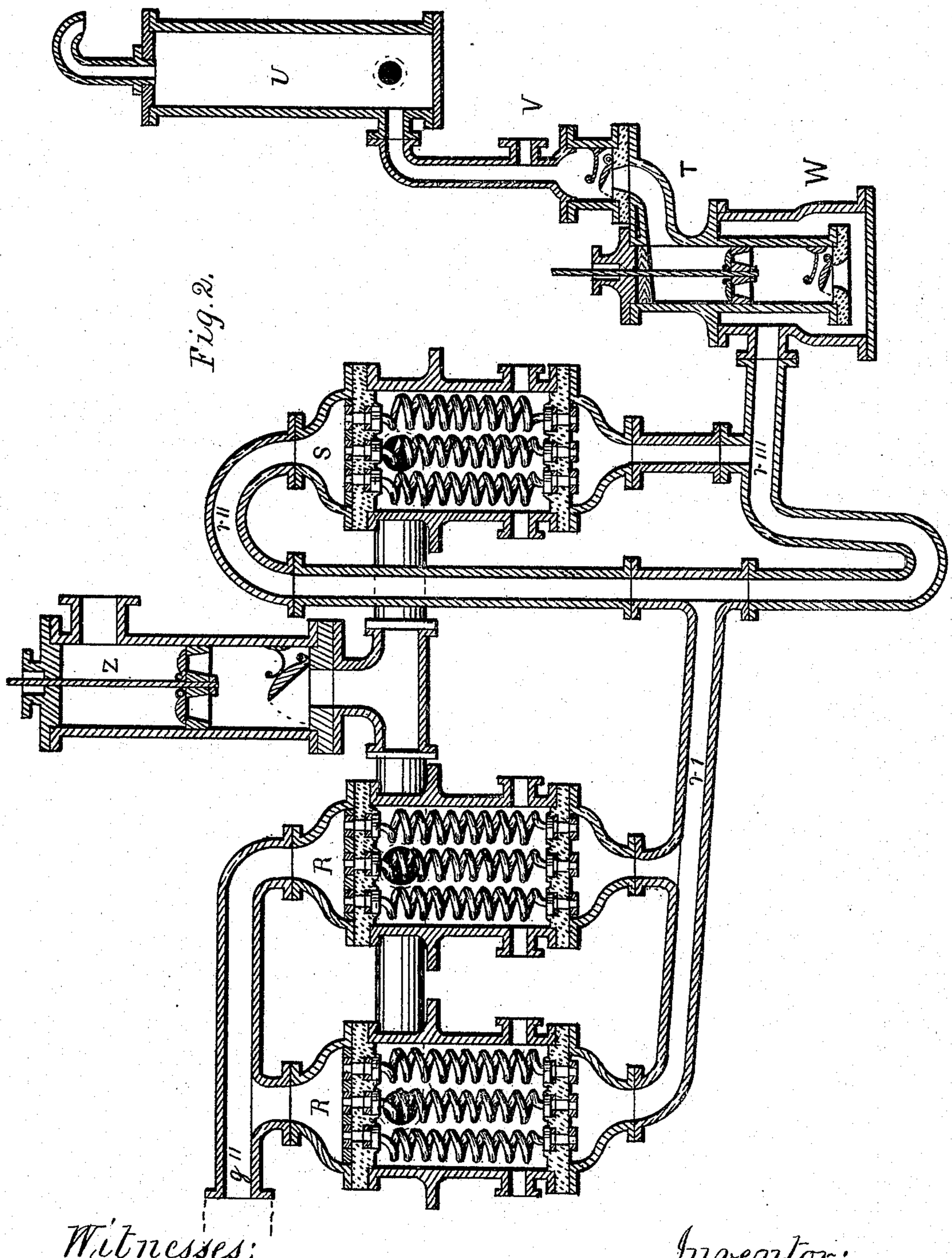
Fig. 2.



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Inventor:
John Houpt

UNITED STATES PATENT OFFICE.

JOHN HOUPT, OF SPRINGTOWN, PENNSYLVANIA.

IMPROVEMENT IN COMPOUND CONDENSING APPARATUS FOR MARINE STEAM-ENGINES.

Specification forming part of Letters Patent No. **168,901**, dated October 19, 1875; application filed July 29, 1875.

To all whom it may concern:

Be it known that I, JOHN HOUPT, of Springtown, in the county of Bucks and State of Pennsylvania, have invented an Improvement in the Compound Condensing Apparatus for Marine Steam-Engines, of which the following is a specification:

My improvement relates more especially to the compound condensing apparatus for marine steam-engines for certain improvements in which Letters Patent were granted to me, dated September 15, 1874, and numbered 154,951. In said patented apparatus a primary jet-condenser and an expander are used, which, in my present improvement, are dispensed with, and a primary surface-condenser, with peculiarly-constructed steam-dividing valves, and a plurality of secondary surface-condensing cases, substituted between the steam-cylinder of the engine and the tertiary or "save-all" surface-condenser, as will hereinafter be fully and clearly described, with reference to the accompanying drawing, (on two sheets of paper,) in which—

Figure 1 represents the primary surface-condenser and the peculiarly-constructed steam-dividing valves, in connection with the steam-cylinder of the engine, and the necessary salt and fresh water pumps; Fig. 2, the plurality of surface-condensing cases and the tertiary condenser, together with the air-pump, hot-wells, circulating-pump, and the mouth of the hot-water-boiler supply-pipe. Fig. 3 represents a transverse section of the primary surface-condenser on a horizontal line with the inlet-openings for the cold sea-water; and Fig. 4 represents the same section of Fig. 3, in connection with the pipes communicating therewith through the ship's side.

To insure a free and prompt working of the outlet-valve g^5 in the upper dividing valve-chamber G, (see Fig. 1,) I construct a thin, long, narrow tongue or valve-plate of spring-steel, g^5—say, three or four times longer than it is wide—tapered or thinned down, so as to serve as a spring-hinge at its back end, which is then secured down firmly to a cross-barred brass grating, which forms the valve-seat, substantially as represented at g^6, (see Fig. 1,) and also having a cross-barred brass guard, g^7, set above the steel-plate valve, so as to prevent the latter from rising too high—or, say, not much higher than one, two, or three inches—at its front end, according to the magnitude of works. The inlet-openings r^{13}, Fig. 4, for the cold circulating sea-water through the side of the ship into the condensing-cases, respectively, are provided with regulating-valves or stop-cocks r^4, to regulate the quantity of cold circulating sea-water required for the secondary surface-condensing cases R R, Fig. 2, to cool down and condense their portion of the exhaust steam to a temperature a little below that of boiling water under a partial vacuum, as hereinafter will be fully described and set forth. The said device is also intended to regulate the quantity of the circulating water required for the tertiary surface-condenser or save-all S, and the stop-cock r^4 also serves to shut out the sea-water securely when the latter is not wanted for immediate use in their respective condensing-cases. The crank H, which operates the cut-off slide g^4 has two or more sockets, whereby the wrist-pin may be shifted to give either a longer or shorter stroke, as occasion may require, to enable the engineer to adjust and time said slide-valve g^4 to divide the exhaust steam coming from the cylinder A properly between the primary condenser B, (see Fig. 1,) and the secondaries R R, Fig. 2. The said crank H is geared so as to make two revolutions during a single rotation of the main crank-shaft of the engine, so as to divide the exhaust steam coming from either end of the steam-cylinder A.

The operation of the slide-valve g^4 must be adjusted so as to be closed at the time when the exhaust-valve at either end of the steam-cylinder begins to open and to discharge the exhaust steam into the lower dividing valve-chamber G, (see Fig. 1,) at which time a very little preponderance in the pressure of the exhaust steam against the under side of the thin steel-plate flap-valve will raise the front end of the same to its limited opening between the valve-seat and the guard above it, as described, and represented at g^5 in Fig. 1, thus allowing a large portion of the exhaust steam and heat to be drawn off by the secondary surface-condensing apparatus, (see Fig. 2;) but the moment the cut-off slide-valve g^4 opens communication between the steam-cyl-

inder A and the primary condenser B then the outlet-valve g^5 will be closed down immediately onto its valve-seat g^6 (see Fig. 1) by the preponderance of the pressure of the exhaust steam on the upper side of said flap-valve plate g^5, and there will be only a comparatively small remnant of expanded vapor left to be condensed in the primary condenser B, and, consequently, a more perfect vacuum will be produced in front of the steam-piston of the cylinder A than can be economically afforded when all the exhaust steam and heat must be cooled down and condensed by the same condenser, and to produce a good vacuum in front of the piston at the same time.

The primary, secondary, and tertiary surface-condensers, represented, respectively, by B, R R, and S in the drawing, being each furnished with a plurality of spirally-coiled surface-condensing tubes similar to those of an ordinary still-worm, and the ends of said tubes are secured in a perfectly water-tight manner into the brass tube-plates at top and bottom of the condensing-cases by having a shallow stuffing-box around the hexagonal holes in the said brass tube-plates, into which the straight ends of the said tubes are fitted, and having, also, a shoulder or jam-ring secured near the end of the tube, corresponding with the stuffing-box on the inside of the brass tube-plate, and a screw-nut on the end of the tube at the outside of the tube-plate, and stuffing-boxes furnished with vulcanized rubber gaskets respectively, or any other suitable packing, secured by tightening up the screw-nuts on the ends of the tubes, and thus close the jam-rings of the tubes onto the packing in the bottom of the stuffing-boxes, making the perfectly-tight water-joints before stated, and represented at B, Fig. 1.

Having thus described and set forth a special form and construction of surface-condensers, which I believe to be the best for my compound condensing apparatus for marine steam-engines, I would remark that any other suitable form and construction may possibly answer the same purposes when placed in combination substantially in the same manner as primary, secondary, and tertiary condensers for marine steam-engines.

The larger portion of the exhaust steam and heat from the cylinder A, which passes through the dividing valve-chambers G G, Fig. 1, into the secondary surface-condensing cases R R, Fig. 2, is therein cooled down to a temperature which will be a little below that of boiling water, (under a partial vacuum, as hereinbefore stated,) and the hot water of condensation drops down and passes off through the pipes r^1 and r^3 into the hot-well W below to supply the boilers (not shown) with hot fresh water at a much higher temperature than can be afforded by the ordinary surface-condensers, when depending upon them for a good vacuum before the piston of the steam-cylinder. The hot vapor from the secondary surface-condensing cases R R being drawn off by the action of the air-pump T through the pipe r'' into the tertiary surface-condenser or "save-all" S, is therein condensed to save the remnant of fresh water for the steam-boilers, and drops down into the hot-well W, and is then drawn off by the air-pump T and forced up into the hot-well U for supplying the steam-boilers with hot fresh water, substantially as represented in the drawing. The surface-condensing cases, as represented at B, R R, and S in Figs. 1 and 2, are comparatively small, and detachably connected together, and all of them made from the same patterns, and consequently any one of them can be readily detached and substituted by another when it becomes foul or out of order, and thus delay for repairs is entirely avoided.

When the engine is worked at a light pressure of steam, as is frequently the case, there will, in that case, be less cooling-surface required by the secondary surface-condensers, and having a plurality of comparatively small surface-condensing cases connected with the exhaust-steam tube of the engine—say, from four to six or more, according to the size of the works, instead of two only—as represented by R R, Fig. 2, then any one or more of said plurality of cases may be throttled off by any suitable arrangement of throttle-valves or stop-cocks, so as to regulate the quantity of cold circulating sea-water in the remainder of the cases, to reduce the temperature of the exhaust steam within them to a temperature a little below boiling water under a partial vacuum, and thus return the fresh water of condensation to the steam-boilers at a temperature much higher than can be afforded by the ordinary surface, or even by jet, condensers.

I claim as my invention—

1. The thin spring flap-valve g^5, of steel, constructed as described, in combination with the valve-seat g^6 and guard g^7, substantially as and for the purpose hereinbefore set forth and described.

2. The primary surface-condenser B, in combination with the dividing-valves in the chamber G G and the secondary and tertiary surface-condensers R R and S, substantially as set forth and described.

JOHN HOUPT.

Witnesses:
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WM. H. MORISON.